II.H. Major Research and Public Service Activities

R&D EXPENDITURES : Fiscal Year 2009

Institution: New Jersey Institute of Technology

	Amount (Dollars in thousands)
Federally Financed Academic R&D Expenditures	50,051
Institutionally Financed Academic R&D Expenditures	31,417
State, Industry & Other Financed R&D Expenditures	10,850
Total Academic R&D Expenditures	92,318

Note: Draft Audit results to be reported to the National Science Foundation (NSF) on Form #411 (Survey of Research and Development Expenditures at Colleges and Universities).

Research and development is a fundamental component of the NJIT mission. NJIT is one of the three public research universities within the state system – that is, mission directed to offer a comprehensive array of Ph.D. programs – and of the three the only one specifically oriented towards professional studies including engineering, the physical sciences, computing sciences, the design professions and management. It is "New Jersey's Science and Technology University".

While *research* activity may be viewed as end unto itself, it is also a powerful enabler for all of the university's mission elements. Faculty members engaged in research bring real-world application and a contagious enthusiasm to the classroom, and in some cases even advance the technologies used in *instructional* activities. The competency built through independent scientific research allows the university to assist the state in a wide variety of public service activities that range from community planning and transportation policy to child-safe hand gun technology legislation. With strong roots in the application of scientific discovery to practical purpose that comes from a 126 year-long heritage in engineering, the university recognizes the importance of contributing to the local, regional and national *economic development*. The university fosters an intimate connection between its faculty and student researchers and the business community in the form of formal partnerships with companies ranging from start-ups in our own Enterprise Development Center, the state's oldest and largest technology business incubator, to global OEMs.

NJIT research is "at the edge of knowledge". By that we mean our researchers are at the forefront of their professions and proactively working to connect scientific discovery to practical application. Some examples follow that are organized around thematic areas of particular significance to new Jersey – healthcare and the life sciences, alternative energy and sustainable systems homeland security, and information and communication technology.

II.H.1. Life & Healthcare Science and Engineering

Amazing progress is occurring in the life sciences as improved understanding of the molecular origins of life move medicine from heuristic and statistical approaches to predictive models. This is the province of engineering, math, physics chemistry and computing that are the defining disciplines of NJIT. From miniaturized, implantable sensors and advanced imaging through new bio-inspired materials to biological and pharmaceutical drug discovery NJIT has the disciplinary tools to break new ground. Some examples of NJIT research at the edge of healthcare systems follow.

A critical element of healthcare improvement pertains to the reduction of cost for bringing new pharmaceuticals to market. Nano-particulate technology offers many benefits for increased potency and targeted drug delivery. The NSF-supported Engineering Research Center in Structured Organic Composites will establish cutting-edge research, technology transfer, and educational/outreach to transform products and processes used for pharmaceutical, nutraceutical, and agrochemical delivery applications. The Center is a partnership between Rutgers University, NJIT, Purdue and the University of Puerto Rico, Mayaguez. Improved technology will result in reduced cost and more consistent and reliable manufacture of biocompatible products as well as science-based, faster development of new products, and a more competitive US industry. Impact will be maximized by focusing on six technology test beds (integrated manufacturing platforms) that focus on multiple methodologies for synthesis of functionalized materials and finished products.

Treena Livingston Arizneh, associate professor and interim chair of biomedical engineering, winner of an NSF Presidential Early Career Award for Scientists and Engineers (PECASE) award, the highest national honor for young scientists and engineers, for her research with adult stem cells received a $700,000 grant from the New Jersey Commission on Spinal Cord Research, a state agency that funds spinal cord research. She will use the grant to build a laboratory to test if stem cells taken from adult bone marrow can be made to turn into neurons. If her research shows that the cells can turn into neurons -- the nerve cells in the body that control brain and spinal cord function -- patients with spinal cord injuries could be healed with injections of stem cells. Arinzeh's second $300,000 grant, from the New Jersey Commission on Science and Technology, will allow her to apply her stem cell techniques to help patients who have cartilage damage. She and Jaffe will spur cartilage regeneration by combing stem cells with bio-degradable scaffolds that mimic fibers found in human cartilage tissue. They will test different scaffolds and determine which biomaterial is the best catalyst for stem cell differentiation. Again, their hope is that stem cells can soon be used to treat patients with damaged cartilage.

NJIT researchers Iqbal Zafar, PhD, research professor and Somenath Mitra, PhD, acting chair and professor, department of chemistry and environmental sciences have developed the concept for a biologically powered fuel cell that would utilize sugars in the blood steam as a renewable energy source for implanted medical devices. The approach integrates micro- and nano-fluidic platforms, electrodes and membrane/electrolyte separator into a biologically compatible, encapsulated biomedical device. It utilizes aligned single wall carbon nanotubes with high ballistic electrical conductivity, and rapid, green microwave-assisted enzyme

covalent functionalization of nanotube tips or sidewalls to provide for stable long term performance.

Tara Alvarez, associate professor of biomedical engineering, received a prestigious Faculty Early Career Development Award from the NSF to support her work in neural engineering and vision research and to enhance the Vision and Neural Engineering Laboratory. The grants support the early career development of teacher-scholars who integrate research and education. Her research focuses on how the brain learns when visually locating objects in three dimensional space to gain a better understanding of basic motor control and motor learning. She also plans to offer courses for undergraduates and to develop educational programs for pre-college girls to attract them to the field of neural engineering.

Michael Jaffe, research professor of biomedical engineering and chemistry directs collagen research at the Medical Device Concept Laboratory (MDCL). MDCL projects focus on reconstituted collagen fiber formation, collagen characterization - both as a "material" and as tissue engineering substrate, collagen mechanical properties and transport of small molecules through skin. One project of special interest is a collaboration among Treena Arinzeh and Sam Hessami (OB/GYN) and Fred Silver (pathology) of UMDNJ, aimed at understanding the collagenous failure that leads to uterine prolapse, a major problem in women's health.

Biomedical engineers at NJIT will use new technology to help children with cerebral palsy improve their movements, reduce stiffness in their joints and live fuller and more independent lives. Small robots mounted on wheelchairs, interactive video games and a robotic arm that can be programmed to guide and aid human motion – these are just a few of the technologies the engineers will use to help these children improve their muscular control and movements. The program led by BME associate professor Richard Foulds is part of a the newly formed Rehabilitation Engineering Research Center (RERC) at NJIT, funded by a $4.75 million grant from the National Institute on Disability and Rehabilitation Research, in Washington, D.C. The institute supports research for the rehabilitation of people with disabilities. The grant, awarded on Nov. 1, 2005, will run for five years.

New Jersey Institute of Technology (NJIT) computer scientist Yehoshua Perl, PhD, creates elegant logical structures to track down errant or misplaced medical terms. The errors creep into documents and databases developed by corporations, government agencies, hospitals and academic institutions that design, maintain and use terminologies throughout a variety of systems. Perl’s research is funded by a three-year $1.43-million grant from the National Library of Medicine (NLM), a branch of the National Institutes of Health.

Interactions among neuropeptides and microglial cells in the brain are the research focus of G. Miller Jonakait, dean of the College of Science and Liberal Arts and professor of biological sciences. With grant support from the National Science Foundation, she is looking at how neurons and glia interact both in the normal brain and in the damaged or diseased brain. Several specific neuropeptides seem to play a role in regulating microglial responsiveness, particularly in dampening the inflammatory response. Dr. Jonakait is exploring this neuronal/glial cross-talk hoping to understand the ways in which neurons affect glia and glia affect neurons.

II.H.2. Sustainable Systems

New Jersey is prototypical of many areas where the co-location of dense population centers and industrial systems needs to be successfully managed to maintain quality of life while promoting economic development. Preservation of air, water and land quality; efficient transportation systems for goods and people; affordable, environmentally benign housing and office space; disaster resistant infrastructure; are all empowered through the technological developments at NJIT. The combustion of petroleum-based fuels is the least thermodynamically efficient technique for powering the global demands for energy. The oil crisis of the 70's, repeated now, and the recognition that global warming due to the accumulation of the products of combustion has at least some scientific merit makes it clear that disruptive technology is required. Alternative energy research is actively underway at NJIT. Were these not enough, creating a safe and secure environment for our citizens in the face of international terrorism creates new challenges to develop and depoy sustainable models for homeland security. Some examples of NJIT research at the edge of sustainable systems technology follow.

Conventional solar cells are made of silicon. But the material that is deposited on the silicon chips cannot be coated. Professor Som Mitra, acting chair of the department of chemistry and environmental science, however, is experimenting with polymers that when dissolved in a solvent become like a paint, and thus can be used as a coating. Developing organic solar cells from polymers is a cheap and potentially simple alternative energy. Solar cells can be inexpensively printed or simply painted on exterior building walls or roofs of houses and buildings. The solar cell uses a carbon nanotube complex, which is just a molecular configuration of carbon in a cylindrical shape and tiny carbon buckyballs (a circular-shaped carbon structure) to form snake-like structures. Buckyballs trap electrons, although they can't make electrons flow. But when you add sunlight to excite the polymers, the buckyballs will grab the electrons. Nanotubes, behaving like copper wires, will then make the electrons or current flow.

Chemical engineer Kamalesh Sirkar, PhD, a distinguished professor and an expert in membrane separation technology, is leading a team of researchers to develop a breakthrough method to desalinate water. Sirkar holds more than 20 patents in the field of membrane separation. Using his technology, engineers will be able to recover water from brines with the highest salt concentrations. The process will work especially well with brines holding salt concentrations above 5.5 percent. Currently, 5.5 percent is the highest percentage of salt in brine that can be treated using reverse osmosis. The Bureau of Reclamation in the Department of Interior is funding the project.

Michael Jaffe, research professor of biomedical engineering and director of the Medical Device Concept Laboratory has teamed with the Iowa Corn Promotion Board to identify polymer opportunities based on monomers derived from corn. The study will look at the potential of corn derivatives as readily available and inexpensive sources of new polymeric materials. Materials to be investigated range from new, bio-erodible polymers for medical applications to improved, bio-compatible coatings and plastics.

A better understanding of the solar flares that can interfere with wireless communication and damage satellites in Earth's orbit is the focus of research by the Center for Solar-Terrestrial Research. Professor Phil Goode directs the Big Bear Solar Observatory on a mountaintop in California. In the fall of 2008 he completed a multi-year, multi-million dollar, federally financed construction project that resulted in the world's largest ground-based optical solar telescope. CSTR research will lead to new understandings of the sun's complex behavior and its effect on our own environment. Dale Gary, professor of physics and specialist in radio solar physics, is leading a design study for the Frequency Agile Solar Radiotelescope (FASR). The project, supported by the National Science Foundation, will construct a new radio telescope capable of making high-resolution images of the solar corona. The telescope, which will consist of 100 receiving dishes, will allow scientists to study the birth of coronal mass ejections, violent phenomena associated with the Sun's magnetic fields that can cause sudden, intense fluctuations in the solar wind and serious consequences on Earth. The high-energy particles that characterize these ejections have the potential to destroy satellites. The satellites in turn may impact television viewing, pagers, cellular phones and other wireless devices. With the ability to observe these phenomena, especially those on the near face of the sun that most affect Earth, researchers will be able to provide better information on the space environment to airlines, power companies and satellite operators. Eventually, solar researchers may be able to predict the severity of such incidents and when they will occur.

The New Jersey Applied Water Research Center, directed by Taha Marhaba, associate professor of environmental engineering, has been established by NJIT in partnership with the American Water Works Association to unite industry, government and academia in a common effort to research and improve the state's drinking water. Researchers from NJIT and the Water Works Association, a non-profit group dedicated to providing the state with safe drinking water, expect to have a significant impact on the state's water infrastructure. The center's emphasis on applied research specific to New Jersey will fill in the gaps that national research programs have not addressed. Researchers will also work to assure that the region's water supply is safe from bio-terrorist attacks, developing monitoring systems to identify biological agents deposited in the water infrastructure.

NJIT has been designated as the Liberty Corridor Planning Institute. In this capacity, NJIT researchers are engaged in creating the framework under which over $100M in federal funds will be invested to improve New Jersey's transportation infrastructure to support the ten-fold growth in containerized shipping that is projected as part of the Port Newark expansion. The objective is to facilitate the movement of import and export goods within the already congested Port district to facilitate job growth and economic development in the associated trades.

One of the most significant spurs to the growth of NJIT's research program has been the university's emphasis on technologies to assist in homeland security. NJIT is home to New Jersey's Homeland Security Technology Systems Center. The center works to identify faculty expertise as well as technologies under study within the university that have potential to assist in the nation's security programs and to facilitate partnerships with local, state and federal agencies for homeland security initiatives. One of the first projects undertaken by the

Homeland Security Technology Systems Center was smart camera surveillance system at the Garden State Plaza Mall in Paramus, directed by Donald H. Sebastian, the university's senior vice president for research and development. The system, developed as a national prototype, uses mall security cameras in combination with special software designed to search for suspicious objects or behavior and alert local authorities. With special funding from Acting Governor Richard Codey, a similar model system has been installed at the Beatrice Gilmore School in West Paterson. NJIT has funding from the N.J. Department of Law and Public Safety to protect schools and shopping malls.

In one of the most promising homeland security initiatives, university researchers continue to develop applications that utilize terahertz (THz) electromagnetic radiation to detect and identify explosives and biological agents. A team of researchers led by John Federici, professor of physics, received a patent for a terahertz imaging system that could be used in airports to detect potentially harmful materials even if they are concealed in clothing, sealed packages, or suitcases. The team also has funding from the Army Research Office, and their industrial collaborator, Picometrix, Inc., of Ann Arbor, Mich., a manufacturer of high-speed optical receivers and ultrafast instrumentation, has a Phase II Small Business Innovative Research (SBIR) grant to develop the system. Above, Federici displays one of the homodyne modules developed by Picometrix that will collect data for the system. Other projects related to homeland security include: • With NSF funding, Haim Grebel, professor of electrical and computer engineering, is developing new concepts for producing infrared filters based on intergrated circuit microstructure technology. His group plans to develop and test filters for all types of spectral sensors applied to a broad range of monitoring and detection systems from the visible to the THz region.

A new technology that can verify a person's identity using facial images is the goal of research by Chengjun Liu, assistant professor of computer science. He has developed a face recognition system that improves on previous technology by taking into account such factors as lighting and facial expressions. The system has tested 100 percent effective in matching videotaped images to those stored in government databases by comparing 62 features or facial landmarks. Such a technology can be used as a security system with facial identification replacing a physical key or a password. An effective face recognition system could also assist law enforcement officials in locating fugitives by means of video cameras strategically placed in public places such as airports. Liu recently received funding from the Department of Defense to support his research as part of the government's effort for combating terrorism using face recognition technologies.

A biometric identification system based on Dynamic Grip Recognition developed in NJIT's personalized weapons project could also be effective in preventing skyjackers from taking control of aircraft. The research team is developing a prototype "smart gun" using silicon-based piezo-electric pressure sensors embedded in the gun grip. The system can identify the user based on the unique "signature" of the individual hand during the first instant of trigger pull. On-board decision electronics and micro-mechanical systems-based actuators then react to either enable or block the firing mechanism. Biometrics expert, Michael Recce, professor of information systems, has also applied for a patent to adapt his hand grip technology for use by airplane pilots. Since operation of modern aircraft frequently shifts

between the pilot and ground controllers, Recce reasoned that the installation of his grip sensors in the cockpit controls could be achieved with relative ease because only the authenticated grips of the pilot or copilot could be programmed to operate the plane. When the pilot releases his or her grip, control of the plane would revert to the ground. The concept of dynamic biometrics is also being extended to other devices such as keypad entry systems where the rhythmic pattern of data entry reveals an underlying structure that is unique to the individual, reproducible and detectable.

M. Ala Saadeghvaziri, professor of civil and environmental engineering, has received start-up funding from the Multidisciplinary Center for Earthquake and Engineering Research at the University of Buffalo to develop proof of concept for an innovative water-based protective technology that could be used to mitigate the effects of explosions or earthquakes on public buildings such as schools and hospitals.

David Mendonca, assistant professor of information systems, is investigating how training in improvisation can help improve the tactical response to large-scale emergencies like the 2001 World Trade Center attack. With a prestigious NSF Faculty Early Career Development award, he hopes to develop software that can help emergency response personnel to make the right decisions under pressure.

The work of Associate Professor Eliza Michalopoulou in ocean acoustics has a compelling and timely bottom line — national defense. With expertise in both mathematical analysis and signal processing, she studies how sounds move in the ocean and how they are affected by factors like temperature, ocean depth, seafloor composition and currents. The main goal is to help the U.S. Navy, which supports her research through the Office of Naval Research, to identify better techniques for detecting underwater vehicles, particularly along the nation's seacoasts. The end products of her work are algorithms that can be used in developing next-generation security systems.

Dr. Michael Chumer of the Information Systems department is working on a variety of advanced software architectures to support emergency response and homeland security applications. By developing interoperability standards these architectures facilitate rapid integration of high performance software applications into a virtual command and control support system. With direct support from the US Army, some of these concepts are being demonstrated in conjunction with combat unmanned systems management. The concepts are being field tested in a Business Emergency Operation Center operating at Picatinny Army base. In a partnership with ARDEC and the New Jersey Business Force, the team is developing and implementing private sector integration with the public sector emergency management function. Software and communications interoperability standards are emerging that will facilitate a more resilient response and recovery should New Jersey face any mass casualty event.

II.H.3. Digital "Everyware"

The mass-impact of computing technology and the ultimate delivery on the promise of digital convergence will only come when information is available anywhere, anytime and for

anyone (or anything!). The development of ubiquitous broadband connectivity will in turn drive transformational products based on distributed intelligence and novel human interface concepts. Some examples of NJIT research at the edge of information and communications technology follow.

Envisioning a future in which wearable computers help students locate their friends on campus and even facilitate introductions to new acquaintances with similar interests, a team of researchers led Quentin Jones, associate professor of information systems and Christian Borcea from computer science, are working to make NJIT a national prototype SmartCampus. The project is supported by funding from the National Science Foundation and Hewlett-Packard. The team will develop a mobile, wireless NJIT campus community system along with the software and protocols to support a wide range of location-based computing services. The team will create privacy-sensitive applications that make use of contextual factors — the properties of people and places and the relationships between them — that are unique to people to people to places, or P3 systems such as SmartCampus. The project will also enrich the curriculum — the team foresees the development of masters programs in human-computer interaction and information assurance and new courses in such areas as wireless security and wearable computing.

Breakthrough discoveries by research professor Reggie Farrow may make the dream of ubiquitous computing a near-hand reality. He has devised a technique for creating nano-transistors by building functionalized carbon nanotubes one element at a time. Using electrophoresis, his research has been able to create nano-devices in the though holes of conventional micro circuitry. This means that the tremendous size reduction and performance gains of nanotechnology can be immediately take advantage of the technology base for conventional micro-fabrication to produce fully functional devices without waiting for advances in nano-wiring or other ancillary process steps. The work has received over $1M in external support, principally from US DOD's DARPA.

NJIT is advancing wireless technology on many fronts as well as bringing related social issues into sharper focus. Wireless innovations have flowed from NJIT's Center for Wireless Communications and Signal Processing Research (CWCSPR), affiliated with the Electrical and Computer Engineering Department, for more than twenty-five years. The center's founder, Yeheskel Bar-Ness, continues to direct the group's initiatives. Bar- Ness, distinguished professor and Foundation Chair, exemplifies the creative thinking that has generated dozens of patentable improvements in wireless. Bar-Ness' name is on many of the patent applications filed over the years, and his pioneering research led to being honored as a New Jersey Inventor of the Year in 2006 and receiving a 2008 Edison Patent Award from the Research and Development Council of New Jersey.

Alex Haimovich, professor of electrical engineering, is developing a new type of network using multiple antennas that could accommodate both a high-speed information link and a sensor network for security or medical monitoring within the same frequency space. With NSF funding, his research team is seeking to develop solutions that can support a wide variety of applications simultaneously within a home or business. The team's goal is a new type of network characterized by multiple antennas and multiple appliances (MAMA).

Roberto Rojas-Cessa, assistant professor of electrical and computer engineering, is leading a team of researchers who are developing a new service model concept, called service vector, as a solution for providing quality of service support for a large variety of traffic classes — Internet, video, audio, business and data services — that challenge the next-generation information networks. The study has NSF funding.

Data watermarking, intrusion alarm systems and distortionless data hiding are some of the techniques under study at the Center for Wireless Networking and Internet Security. A partnership between NJIT's Department of Electrical and Computer Engineering and Princeton University, the center was supported by a $2.6 million R&D Excellence Grant from New Jersey Commission on Science and Technology. Professor Yun Shi of the department of electrical and computer engineering has been awarded a number of patents based on his work in steganography and data watermarking, and these are now being commercialized.

Functional nanostructures for novel electron devices are the focus of the Integrated Nanostructures Laboratory, headed by Leonid Tsybeskov, associate professor of electrical and computer engineering. In one project supported by the National Science Foundation, the team is investigating links between structural and optical properties in three-dimensional nanostructures made of silicon and germanium, the most common materials for semiconductors. Visible photo luminescence from Si nanocrystals and different forms of organization in Ge nanocrystals grown on a Si substrate are recent discoveries, and Dr. Tsybeskov is exploring the feasibility of novel devices that make use of efficient light emission in these nanostructures. Hewlett-Packard and IBM are partners on the project.

II.H.4. Research Centers and Specialized Labs

NJIT's research program focuses on applied research in the most promising of emerging technologies, with emphasis on technology transfer and commercialization. Research at NJIT is organized around multi-disciplinary centers of excellence that encourage partnerships among various disciplines, as well as with other educational institutions, private enterprise and government agencies.

APPLIED LIFE SCIENCES

- Newark Institute for Regenerative Healthcare develops process technology to bring stem cell – based therapies to practical, reproducible, commercial scale.
- Biomedical Engineering: Stem cell applications in tissue regeneration, vision and neural engineering, bioMEMS, motion analysis and rehabilitation engineering, biomaterials and biopolymers.
- Center for Applied Genomics: Development and application of DNA microarray technology.
- The Medical Device Concept Laboratory : Synthetic materials in biomedicine.

- Membrane and Separation Technologies: Micro- and nanoporous filters for medicine and pharmaceutical manufacture.
- The Vision and Neural Engineering Lab: Oculomotor dynamics, vergeance eye movements.

ARCHITECTURE AND BUILDING SCIENCES

- Center for Architecture and Building Science Research: Educational facilities, health care and aging environments, developmental disabilities planning, historic preservation, housing and community development.
- Concrete Testing Laboratory: Reinforced and high-strength concretes.

COMPUTING, MATHEMATICS AND TELECOMMUNICATIONS

- Center for Applied Mathematics and Statistics: Mathematical biology, fluid dynamics, wave propagation.
- Center for Wireless Communications and Signal Processing Research: Multi-carrier systems, Turbo Coding techniques, ultra-wideband communications, MIMO systems.
- Cryptography & Telecommunication Laboratory: Cryptography, computer security and telecommunications networks.
- electronic Arts Habitat (eArtH): Multimedia, social computing, human-computer interaction.
- New Jersey Center for Wireless Networking and Internet Security: Intrusion detection, watermarking, mobile networks.

ENVIRONMENTAL SCIENCE AND ENGINEERING

- York Center for Environmental Engineering and Science: Hazardous substance management, pollution remediation and prevention, sustainable manufacturing.
- Geoenvironmental Engineering Laboratory: Solid waste management and disposal, environmental systems, waste water treatment, site remediation.
- Laboratory for Process and Field Analytical Chemistry: On-line process analysis, environmental monitoring, portable instruments for on-sire environmental measurement.

MATERIALS SCIENCE AND MANUFACTURING

- Bearings and Bearing Lubrications Laboratory: Hydrodynamic, hydrostatic, rolling element bearings and novel designs of unique bearings.
- Computational Fluid Dynamics: Particulate flows, mixing enhancement, suppression/enhancement of turbulence, drag minimization, thermal management.

- Electro-hydrodynamics Laboratory: Sensors and separation devices for a wide variety of systems for environment monitoring, health care, and medical diagnostics
- Electronic Imaging Center: Infrared filters, sensors and detectors utilizing terahertz radiation, carbon nanotubes.
- W.M. Keck Laboratory: Manipulation of liquid flows and the small particles/microorganisms they transport in biological and biomedical technologies.
- Materials Characterization Laboratory: Elemental. organic and structural analysis
- Metal Combustion Laboratory: Propellants, explosives, pyrotechnics, and incendiaries.
- Microelectronics Fabrication Center: Application-specific integrated circuits, optical switches, pressure sensors, and MEMS for biomedical, biometrics, and microfluidics application.
- New Jersey Center for Engineered Particulates: Tailored particle coatings for pharmaceuticals, food, cosmetics, ceramics, defense, electronics and specialty chemicals.
- New Jersey Center for Microflow Control: Fluidic devices, with a focus on miniaturized flows, and miniaturized sensors and actuators.
- Polymer Processing Institute: Modification of polymers processing into special property products for the medical, health care, automotive, electronics, construction, and packaging industries
- Waterjet Technology Lab: Waterjet machining and cleaning applications.

SOLAR PHYSICS

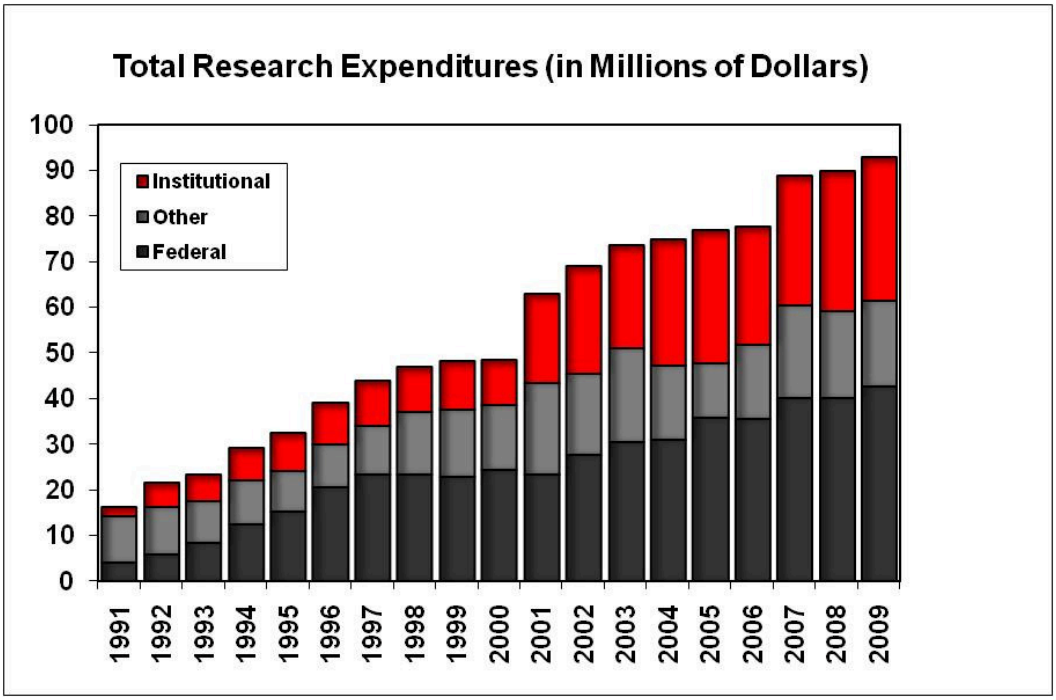
- Center for Solar-Terrestrial Research: Solar optical astronomy, solar radiophysics, terrestrial science.
- Big Bear Solar Observatory: Solar observation, helioseismology.
- Owens Valley Solar Array: Transient energetic phenomena, coronal magnetic fields.
- The Frequency-Agile Solar Radiotelescope (FASR) Project: Nature and evolution of coronal magnetic fields, physics of solar flares, drivers of space weather, the quiet Sun.
- Global High-Resolution H-Alpha Network: Round-the-clock solar observation.
- Space Weather Project: Monitoring and forecasting solar activity that may affect Earth's climate and technologies.

TRANSPORTATION

- Liberty Corridor Planning Institute: Port Newark, Elizabeth, Bayonne redevelopment; Freight transportation, brownfields and passenger transportation
- North Jersey Transportation Planning Authority: Maintaining and improving transportation systems.
- Transportation, Economic and Land Use System (TELUS): Computerized transportation planning and programming.

II.H.5. NJIT Research Expenditures

NJIT research expenditures since 1991 have grown six-fold and Federally funded research expenditures have grown even more dramatically – more than tenfold in eighteen years.



II.H.6. Incubator Expansion

The opening of a third Enterprise Development Center (EDC III) in 2002 makes NJIT's small business incubation program one of the largest in the nation. With 80,000 square feet in five stories, EDC III doubles the previous incubation space. Three floors in the new structure are earmarked for technology start-up businesses, while the remaining two floors will provide "graduation" space for companies that have outgrown an incubation program.

EDC, founded in 1988 by NJIT, with assistance along the way from Prudential, the New Jersey Commission on Science and Technology, the New Jersey Economic Development Authority, and the U.S. Economic Development Administration, is the oldest and largest incubator facility in New Jersey, which is currently serving more than 80 client businesses. EDC provides a broad base of support and acts as a "proving ground" for new and developing high-tech products. Many client companies are developing commercial enterprises that reflect the university's major thrusts in information technology, health sciences, environmental science and engineering, and materials science and engineering. The university provides the latest technical information, including access to the university's specialized equipment, faculty experts and students. The success rate for EDC businesses is higher than 85 percent; more than 50 businesses have graduated from the incubator facility.

Based on its experience in high-tech business incubation, NJIT has placed a focus on increasing the depth and breadth of services that these incubators can offer to resident firms. In particular, the objective should be to promote business acceleration – growing companies more rapidly from business concept to fledgling business. On the technological front, underwriting the expense of access to university based personnel and equipment assets and facilitating the ability to compete for federal and foundation grant funding will more rapidly move companies to critical “proof of concept” and reduce the inherent risk to investors. In addition, adding new professional services liked shared support for marketing, information technology infrastructure, management team building and other critical growth items will increase the flow of successful businesses from existing incubators. NJIT has won several grants from the NJCS&T and has application spending with the National Science Foundation to further enhance its concepts for new business acceleration – and these are viewed as critical competitive advantages for the NJ-EDA led Innovation Zone program in Newark.

II.H.7. Helping Businesses Get Lean

More that 100 New Jersey manufacturing firms benefited this year from the technical assistance programs of the Center for Manufacturing Systems (CMS). The center, directed by Wayne Chaneski, offers services that range from identifying short-term productivity improvement opportunities to long-term engagements geared toward streamlining entire operations. CMS also assisted companies with product design and prototyping, process development, plant layout, machining of complex parts, and training in modern manufacturing concepts.

Training in lean manufacturing is one of the center's most popular services. Lean techniques -- inventory reduction, reduced lead time, continuous flow, increased flexibility -- are critical to the small and mid-sized manufacturing businesses that are the center's clients. One project for Purepac Pharmaceutical, an Elizabeth-based manufacturer of generic drugs, focused on reducing setup time -- the time a machine is out of service for changeover between the end of one run and the beginning of another. The CMS team videotaped an actual machine setup, then helped employees to review the process and identify solutions to problems. One department also got 5S training (Sort, Set-in-Order, Shine, Standardize, and Sustain) for improving efficiency by reorganizing workspace.

II.H.8. New Jersey Immunization Information System and the New Jersey Local Information Network & Communications System

NJIT has put into production for statewide use the New Jersey Immunization Information System (NJIIS) and the New Jersey Local Information Network and Communications System (NJLINCS) for the New Jersey Department of Health and Senior Services (NJDHSS).

NJIIS is an on-line immunization registry capable of enrolling all New Jersey children at birth and recording and evaluating their immunization histories for completeness under the Center for Disease Control and Prevention's current guidelines. Over 150,000 children are currently in the registry and more than 150 health departments, clinics and private physician's offices are currently participating via dial in modems or the Internet. NJIT installs client software at user sites, operates the servers and provides administrative and technical support for the NJIIS.

NJLINCS is an Internet based communications system that will link all local health departments with the NJDHSS in Trenton. NJLINCS provides rapid, two-way communication between state health officials and local health officers for dissemination and collection of health related information and data. NJIT operates the servers and provides administrative and technical support for the NJLINCS.

II.H.9. Assistance to Business

NJIT offers direct assistance to business through several services to small- and medium-sized businesses to encourage their growth and success. These services are delivered primarily through NJIT’s six-business assistance centers:

- Technology Extension Program in Manufacturing Engineering (a component of the New Jersey Manufacturing Extension Partnership – NJMEP): a statewide manufacturing extension program to help small- and medium-sized manufacturing businesses to modernize and become more competitive
- Center for Information Age Technology (CIAT): integrates computer technology into the operations of New Jersey business, government, non-profit and educational organizations

- Center for Manufacturing Systems: assists manufacturers with prototype product development, process improvement and modernization with high speed machining center, advanced CAD/CAM and rapid prototyping facilities.
- Defense Procurement Technical Assistance Center: helps New Jersey small businesses obtain defense and other federal contracts
- Enterprise Development Center: small business incubators that help new and developing enterprises survive the typically difficult start-up stages;
- New Jersey Technical Assistance Program (NJTAP): helps New Jersey small- and medium-sized businesses comply with state and federal pollution prevention regulations;
- Micro-fabrication Center: serves to assist businesses with design and fabrication services related to silicon processing technologies in the university's clean room for MEMS and CMOS processing;
- Polymer Processing Institute: provides assistance to small businesses in processing of polymers and plastics.

NJIT also provides assistance to business through workforce development activities, research activities, economic development activities, and public service activities.

II.H.10. Sports/Sport Events

The 2008-09 year saw the Athletic Department clear the last major check by the NCAA in our bid to reclassify our Athletic Program to the NCAA Division I level. In February, we received notice from the national office, that we successfully completed the self study certification process, and received full certification.

In 2009-10 we also continue to increase our national visibility. Our men's basketball team played in their first ever nationally televised game, on the Big Ten Network vs. Penn State, and the first regionally televised game on Comcast vs Monmouth. Stories of our teams were discussed nationally on ESPN and the Today Show, and locally on many radio and TV stations, plus written articles in the Star Ledger, Wall Street Journal, and New York Times. We continue to play a national schedule with our teams facing teams in California, Hawaii, Utah, Texas, Florida, and many other states.

Athletic Highlights include our tennis teams better than .500 records, our women volleyball team's 19 victories, fencing sending two people to the NCAA regionals, and one of our cross country runners winning the university division race at the ECAC Championships.

The university upgraded the athletic training and weight room facilities, also renovations began on new locker-room facilities for the men's and women's basketball teams, in addition to a new locker room area for women's track, swimming, and tennis. The men's and women's basketball teams played some games at the new Prudential Center in Downtown Newark., and baseball continues to play their home schedule at Bears & Eagles Riverfront Stadium.

NJIT joined six other independent Division I schools and formed the all sports Great West Conference. Other conference members include: Chicago State, Houston Baptist University, University of North Dakota, University of South Dakota, University of Texas at Pan American, and Utah Valley University

In 2008-09 there were 214 student-athletes. The profile includes 140 males and 74 females. Full and partial athletic scholarships were given to 131 student-athletes whose sum totaled just over $2.2 million. During 2008-09 academic year, 119 scholar-athletes (55%) who participated in varsity sports and earned a GPA of at least 3.0 during the fall 2008. in addition 49 (23%) student athletes are members of the Albert Dorman Honors College. In 2008-09, the university will once again sponsor 19 intercollegiate varsity sports: baseball, M/W basketball, M/W cross country, M/W fencing, M/W soccer, M/W swimming, M/W tennis, M/W indoor and outdoor track, and M/W volleyball.